REMARKS

In the Office Action dated January 9, 2009, the Examiner objects to claims 1-19. Additionally, the Examiner rejects claim 1-19 under 35 U.S.C. §112, first paragraph, and rejects claims 1-19 under 35 U.S.C. §103(a). With this Amendment, Applicant amends claims 1-19. Applicant does not add or cancel any claim. Following entry of this Amendment, claims 1-19 are pending. Applicant respectfully requests reconsideration of the Application as amended.

The Examiner objects to claims 1-19 for informalities as a result of describing elements as "adapted to" perform or "capable of" performing a function. Applicant respectfully disagrees as there is no *per se* rule that elements using these terms do not introduce positive limitations. In fact, each word of a claim must be considered. In an attempt to address the Examiner's objection, however, Applicant amends each of claims 1-19 to incorporate instead the phrase "configured to" where appropriate. Applicant submits that these amendments fully address the Examiner's objections to claims 1-19. Withdrawal of the objections is respectfully requested.

The Examiner rejects claims 1-19 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The Examiner asserts that it is unclear and confusing what Applicant meant by "balancing of a vehicle." The Examiner asks whether the vehicle is balanced when the vehicle is in a stable position, when the vehicle reaches a certain speed, or when the acceleration is zero. (Office Action, p. 3). Applicant respectfully submits that this phrase is fully described in the specification at, for example, FIGS. 2A, 2B, 4A, 4B, paragraphs [0017], [0023], [0029], *et seq.* However, in an attempt to address the Examiner's concerns, Applicant amends the claims to describe the pitch of the vehicle as being level or not level instead of describing the vehicle as being balanced or not balanced. For example, amended claim 1 describes a first pitch that is level and a second pitch that is determined to be level or not level. Applicant submits that these amendments fully address the Examiner's rejection under 35 U.S.C. §112, first paragraph. Applicant respectfully requests withdrawal of the Examiner's rejection on this basis.

The Examiner rejects claim 1 and its dependent claims 2-6 under 35 U.S.C. §103(a) as being unpatentable over Nagaoka et al. (JP 2002-005656) and Xu et al. (US 7,197,388). Applicant has amended claim 1, which now describes a controller operatively

coupled to the memory and configured to determine whether a first pitch of a vehicle at a first time is level and whether a second pitch of the vehicle at a second time is level, and to determine a position of an object in the second image based on the position of the object in the first image if the first pitch is level and the second pitch is non-level.

No cited reference teaches or suggests a controller as described in claim 1. Nagaoka et al. discloses that an optic axis of an image device shifts relative to a vehicle traveling direction. (Technical Problem). As a step for correcting for this problem, Nagaoka et al. discloses capturing a number of images k during a time t. (¶[0021]). However, Nagaoka et al. does not disclose that any of the images are captured at a time when the vehicle has a level pitch and at another time when the vehicle has a non-level pitch. Indeed, the process disclosed by Nagaoka et al. does not take the pitch of the vehicle into account. Instead, after capturing the images k over the time t, Nagaoka et al. discloses determining a distance z between the vehicle and an object. (¶[0026]). The distance z is used to compute a camera coordinate system Xc, Yc, and Zc (¶[0029] and Equation (2)), and the location of the object is represented by coordinates XOc, YOc, and ZOc in the camera coordinate system Xc, Yc, and Zc. Real space coordinates XO, YO, and ZO of the object are calculated from the coordinates XOc, YOc, and ZOc using matrix multiple as shown in Equation (3) and a pan angle phi. (¶[0012]). However, the pan angle phi is an angle in a <u>transverse direction</u> and does not have a vertical component. (¶[0012]). That is, as shown in FIG. 13, the transverse direction is in the horizontal plane and does not provide an indication of the pitch of the vehicle. Moreover, the real space vertical component YO always equals the vertical camera coordinate YOc, as can be understood from the transformation of Equation (3), indicating that the vertical camera coordinate YOc is not modified to arrive at the real space vertical component. Similarly, a yaw angle thetar is an angle in the <u>transverse direction</u> that is independent of the pitch of the vehicle, and the angle thetar can be used to correct for vehicle movement of magnitude D when the vehicle turns in a <u>yaw direction</u>. (¶¶[0043]- [0047] and FIG. 15). Nagaoka et al. does not even appear to be concerned with the vertical coordinate of an image or the pitch of the vehicle.

Nagaoka et al. accordingly fails to teach or suggest a controller configured to determine whether a first pitch of the vehicle at the first time is level and whether a second pitch of the vehicle at the second time is level, and to determine the position of the object in the second image based on the position of the object in the first image if the first pitch is level and

the second pitch is non-level.

Xu et al. fails to cure this deficiency in Nagaoka et al. Xu et al. discloses a roll stability control. A controller 26 is coupled to a sensing system, which can include various cameras 43, and the controller 26 controls a rollover control system 18 to reduce the effects of vehicle roll by adjusting a headlight or suspension level. (Abstract). Xu et al. also discloses analyzing stationary objects, such as the street lights 148, bridges, signs and buildings in captured images to determine the roll angle of the vehicle. (Col. 8, ll. 33-36). Xu et al. merely discloses that two sequential images can be analyzed to determine pitch. (Col. 8, ll. 58-60). While a pitch rate sensor 37 can be included, Xu et al. merely discloses the pitch of the vehicle as being an input to the rollover control system 18 and does not disclose the controller 26 determining when images captured by the cameras 43 are level or not level. Therefore, Xu et al. does not teach or suggest a controller as described in claim 1.

Since neither Nagaoka et al. nor Xu et al., either alone or in combination, teaches or suggests a controller as described in claim 1, claim 1 and its dependent claims 2-6 are allowable over the cited references.

Claim 2 as amended describes the controller as being further configured to compute an image acceleration of the second image, and to determine that the second image was captured when the second pitch of the vehicle was level if the image acceleration of the second image is zero. Neither cited reference teaches or suggests such a controller. In Nagoaka et al., the computed vehicle movement magnitude D is a movement in a <u>yaw direction</u>, and therefore cannot be used to determine whether or not the <u>pitch</u> of an image is level. Moreover, the movement magnitude D is a distance, not an acceleration of an image. In addition, the other values computed in Nagaoka et al., such as the pan angle phi, the angle thetar, and the locations PA, PB and PC shown in FIG. 15, are relative to the <u>transverse direction</u>. Xu et al. discloses using two sequential images to determine pitch rate (col. 8, ll. 58-63), but Xu et al. does not disclose determining an image acceleration, let alone determining that the pitch of the vehicle is level when the image acceleration is zero. Since neither cited reference nor any combination thereof teaches or suggests a controller as described in claim 2, and as a result of its dependency from claim 1, claim 2 is allowable over the cited references.

Claim 3 is amended to describe the controller as being further configured to compute a vertical image velocity of the second image, and to determine that the second image

was captured when the second pitch of the vehicle was level if the second image has a zero image acceleration and a non-zero vertical image velocity. Nagaoka et al. discloses computing the deviation of an optic axis from a vehicle traveling direction in the transverse direction, and each of the values computed in Nagaoka et al., such as the pan angle phi, the vehicle movement magnitude D, the angle thetar, and the locations PA, PB and PC shown in FIG. 15, is relative to the transverse direction. The values related to the transverse direction in Nagaoka et al. are unrelated to the vertical image velocity or the pitch of the vehicle, and therefore the reference does not teach or suggest the controller as described in claim 3. In Xu et al., as explained above with respect to claim 2, the image acceleration is not computed. Since the image acceleration is not computed, Xu et al. cannot disclose determining that the second image was captured when the second pitch of the vehicle was level if the second image has a zero image acceleration and a non-zero vertical image velocity. Therefore, Xu et al. also fails to teach or suggest a controller as described in claim 3. Since neither cited reference nor their combination teaches a controller as described in claim 3, and due to its dependency from claims 1 and 2, claim 3 is allowable over the cited references.

Claim 4 is amended to describe a third image of the object captured at a time when a third pitch of the vehicle is level, and the controller is configured to determine the position of the object in the second image based on the positions of the object in the first and third images. As explained in the description of the references above with respect to claim 1, neither cited reference teaches or suggests capturing an image at a time when the vehicle is level, nor does either cited reference teach or suggest determining the position of an object in an image taken when the vehicle is not level based on the position of the object in an image taken when the vehicle is level. Therefore, in addition to its dependency from claim 1, claim 4 is allowable over Nagaoka et al. and Xu et al. for this reason.

Claim 5 as amended describes a controller configured to compute a distance between the image pickup device and the object in the second image based on computed sizes of the object in the first image and the second image if the second image was captured when the pitch of the vehicle was not level. The computations performed in Nagaoka et al. do not take the pitch of the vehicle into consideration, and therefore Nagaoka et al. does not teach or suggest a controller as described in claim 5. Xu et al. does not teach or suggest computing a distance to an object based on sizes of the object in the images captured at times when the

vehicle is level and not level. Thus, in addition to its dependency from claim 1, claim 5 is allowable over the cited references.

Claim 6 as amended describes the controller as being configured to compute a vision axis of the image pickup device based on the computed distance if the second image was captured when the second pitch of the vehicle was not level, and to compute the position of the object in the second image based on the computed vision axis. Since neither Nagaoka et al. nor Xu et al. discloses computations relying on an image taken when the pitch of the vehicle is not level as explained above in respect to claim 5, neither cited reference teaches or suggests a controller as described in claim 6. Thus, in addition to its dependency from claim 5, claim 6 is allowable over Nagaoka et al. and Xu et al.

The Examiner rejects claim 7 and its dependent claims 8-12 under 35 U.S.C. §103(a) as being unpatentable over Nagaoka et al. and Xu et al.

Claim 7 is amended to describe a controller configured to determine a position of at least one object in a second image based on the position of the at least one object in a first image captured at a first time when a first pitch of a vehicle was level if a second pitch of the vehicle at the time the second image was captured was not level. Nagaoka et al. is not concerned with the pitch of a the vehicle, and the computations in Nagaoka et al. do not disclose determining a position of an object in the second image based on the position of the object in the first image if the second pitch is not level. All of the values in Nagaoka et al., such as the pan angle phi, the vehicle movement magnitude D, the angle thetar, and the locations PA, PB and PC shown in FIG. 15, are relative to the <u>transverse direction</u> and provide no indication of the pitch of the vehicle. Therefore, Nagaoka et al. does not teach or suggest a controller as described in claim 7. The other reference, Xu et al., discloses taking two sequential images (col. 8, ll. 58-60), but provides no indication to use the images to determine the position of the at least one object as claimed. Indeed, Xu et al. does not mention the pitch of the vehicle as being relevant to determining the position of an object in an image. (See, *e.g.*, col. 9, line 4 *et seq.*) Since neither Nagaoka et al. nor Xu et al. teach or suggest the features of claim 7, the combination cannot. Therefore, claim 7 and its dependent claims 8-12 are allowable over the cited references..

Claim 8 describes a controller configured to compute an image acceleration of the second image, among other features. As explained above with respect to claim 2, the cited

references fail to teach or suggest, either alone or in combination, such a feature. Accordingly, claim 8 is allowable based on the features recited therein in addition to its dependence from claim 7.

Claim 9 describes a controller configured to compute a vertical image velocity of the second image and the controller configured to determine that the second image was captured when the second pitch of the vehicle was level if the second image has a zero image acceleration and a non-zero vertical image velocity. Among other things, the cited references fail to teach or suggest computing a vertical image velocity as described with respect to claim 3. The invention of claim 9 is patentable over the cited references for this reason and based on its dependency from claim 7.

Claim 10 describes a controller configured to determine the position of the at least one object in the second image based on the position of the at least one object in the first image and the position of the at least one object in the third image where the third image is captured at a third time when a third pitch of the vehicle is level. None of Nagaoka et al., Xu et al. and any permissible combination of these references teaches or suggests determining the positions of the object as claimed as explained above with respect to claim 4.

Claim 11 is amended to describe the controller of claim 7 is configured to compute a size of the at least one object in the second image based on a size of the at least one object in the first image if the second image was captured when second pitch of the vehicle is not level. The controller is also configured to compute a distance between the image pickup device and the at least one object in the second image based on the computed sizes of the at least one object in the first and second images. As described above with respect to claim 5, the cited references, either alone or in combination, fail to teach or suggest each of these features.

Claim 12 depends from claim 11 and claims the controller is configured to compute a vision axis of the image pickup device based on the computed distance if the second image was captured when the vehicle was not balanced and to compute the position of the at least one object in the second image based on the computed vision axis. Among other things, the cited references fail to teach or suggest the computation of the vision axis as claimed as described above with respect to claim 6. Accordingly, claim 6 is allowable over the cited references for the features recited therein in addition to being allowable based on its dependence from claim 7.

The Examiner rejects claim 13 under 35 U.S.C. §103(a) as being unpatentable over Nagaoka et al. and Xu et al.

Claim 13 as amended describes, among other things, object position computing means for determining the position of an object in a first image if the first image was captured when a first pitch of a vehicle was not level, which determination is based on a second image of the same object that was captured when a second pitch of the vehicle was level. Neither Nagaoka et al. or Xu et al. includes a determination of a position of an object based on two images taken when the vehicle is level and not level, respectively. Nagaoka et al. is only concerned with deviations between an optic axis of an image device and a vehicle traveling direction in a transverse direction. All of the values in Nagaoka et al., such as the pan angle phi, the vehicle movement magnitude D, the angle thetar, and the locations PA, PB and PC shown in FIG. 15, are relative to the transverse direction and provide no indicate of the pitch of the vehicle. Xu et al. discloses taking two sequential images (col. 8, ll. 58-60), but does not disclose determining the position of the object in the first position as claimed. Since neither cited reference teaches or suggests object position computing means as described in claim 13, claim 13 is allowable over the cited references.

The Examiner rejects claim 14 and its dependent claims 15-19 under 35 U.S.C. §103(a) as being unpatentable over Nagaoka et al. and Xu et al.

Claim 14 describes a method for detecting a position of an object comprising determining whether a first image of an object captured by an image pickup was captured when a first pitch of the vehicle was level, and determining the position of the object in the first image if the first image was captured when the first pitch of the vehicle was not level, which determination is based on a second image of the same object that was captured when a second pitch of the vehicle was level. Nagaoka et al. discloses capturing multiple images k over a time t (¶[0021]), but does not disclose determining whether any of the images were captured when the pitch of the vehicle was level. Without determining whether any of the images were captured when the pitch of the vehicle was level, Nagaoka et al. cannot determine the position of the object in an image as claimed. Xu et al. also fails to teach or suggest the method as described in claim 14, as Xu et al. merely discloses capturing two sequential images without regard to the pitch at the time the images were captured. (See col. 8, ll. 58-60). Since neither cited reference teaches or suggests the method of claim 14, claim 14 and its dependent claims

15-19 are allowable over the cited references.

Claim 15 as amended describes determining the first pitch of the vehicle is level if the first image acceleration is zero. Nagaoka et al. does not teach or suggest determining vehicle pitch based on image acceleration, as the computed value in Nagaoka et al., such as the pan angle phi, the vehicle movement magnitude D, the angle thetar, and the locations PA, PB and PC shown in FIG. 15, are all relative to the transverse direction. Further, Xu et al. does not teach or suggest determining vehicle pitch based on image acceleration, as Xu et al. does not even disclose determining image acceleration. Therefore, in addition to its dependency from claim 14, claim 15 is allowable over the cited references.

Claim 16 depends from claim 15 and describes determining the vertical image velocity of the first image, and determining the first pitch of the vehicle to be level if the first image has a zero image acceleration and a non-zero vertical image velocity. As explained above with respect to claim 15, neither cited reference teaches or suggests determining the first image acceleration. Further, neither cited reference teaches or suggests determining a vertical image velocity as claimed. Therefore, in addition to its dependency from claims 14 and 15, claim 16 is allowable over Nagaoka et al. and Xu et al.

Claim 17 as amended describes a third image of the object captured when a third pitch of the vehicle was level and describes the position of the object in the first image is determined based on the positions of the object in the second image and in the third image. Neither cited reference teaches determining whether the pitch of the vehicle was level at the time any image was captured. As a result, and in addition to its dependency from claim 14, claim 17 is allowable over Nagaoka et al. and Xu et al.

Claim 18 as amended describes computing a size of the object in the first image based on the size of the object in the second image if the first image was captured when the first pitch of the vehicle was not level and computing the distance between the image pickup device and the object based on the computed sizes of the object in the first and second images. Since neither Nagaoka et al. nor Xu et al. determines whether an image was captured at a time when the pitch of the vehicle was level or not level, neither reference can teach or suggest computing a size of the object as described in claim 18. Therefore, in addition to its dependency from claim 14, claim 18 is allowable over the cited references.

Claim 19 depends from claim 18 and describes, *inter alia*, computing a vision

axis of the image pickup device based on the computed distance of the object, if the first image was captured when the first pitch of the vehicle was not level. Again, neither Nagaoka et al. nor Xu et al. determines whether an image was captured at a time when the pitch of the vehicle was level or not level, and therefore neither reference can teach computing the vision axis as described in claim 19. Thus, in addition to its dependency from claims 14 and 18, claim 19 is allowable over the cited references.

It is respectfully submitted that this Amendment traverses and overcomes all of the Examiner's rejections to the Application as originally filed. It is further submitted that this Amendment has antecedent basis in the Application as originally filed, including the specification, claims and drawings, and that this Amendment does not add any new subject matter to the Application. Reconsideration of the Application as amended is requested. It is respectfully submitted that this Amendment places the Application in suitable condition for allowance; notice of which is requested.

If the Examiner feels that prosecution of the present application can be expedited through a conference with Applicant, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

YOUNG BASILE HANLON
MACFARLANE & HELMHOLDT, P.C.

Evan Macfarlane
Registration No. 62,716
(248) 649-3333

3001 West Big Beaver Rd., Ste. 624
Troy, Michigan 48084-3107